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The Lunar Dust Pendulum

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Shadowed regions on the lunar surface acquire a negative potential. In particular, shadowed craters can have a negative potential with respect to the surrounding lunar regolith in sunlight, especially near the terminator regions. Here we analyze the motion of a positively charged lunar dust grain in the presence of a shadowed crater at a negative potential in vacuum. Previous models describing the transport of charged lunar dust close to the surface have typically been limited to one-dimensional motion in the vertical direction, e.g. electrostatic levitation; however, the electric fields in the vicinity of shadowed craters will also have significant components in the horizontal directions. We propose a model that includes both the horizontal and vertical motion of charged dust grains near shadowed craters. We show that the dust grains execute oscillatory trajectories and present an expression for the period of oscillation drawing an analogy to the motion of a pendulum.